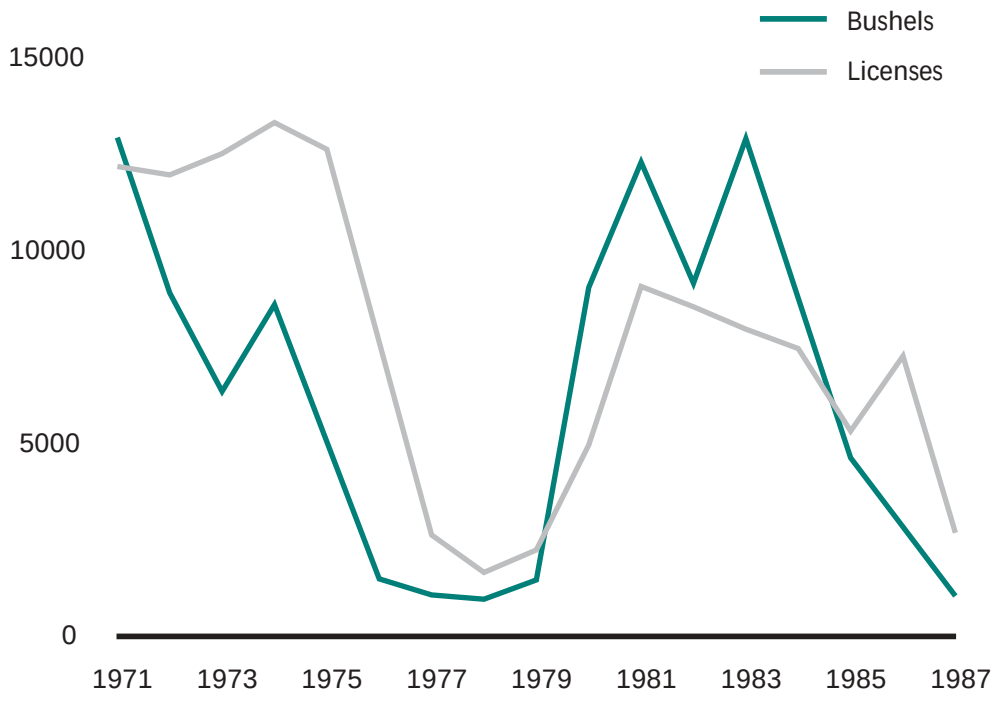
6

SHELLFISH RESOURCES

Declining shellfish populations and associated habitats are among the most significant living resource problems in coastal New Hampshire. According to the New Hampshire Estuaries Project's review of status and trends within the estuaries, oyster habitat and populations in the Great Bay Estuary are in decline and may be at historic lows. Clam densities overall have improved somewhat in the last seven to ten years, but population fluctuations related to harvest pressure in the Hampton-Seabrook Estuary are well documented. Overall, shellfish and other living resources were much more abundant a century ago. Predators, harvesting effects, disease, and changing management scenarios have all contributed to shellfish declines.

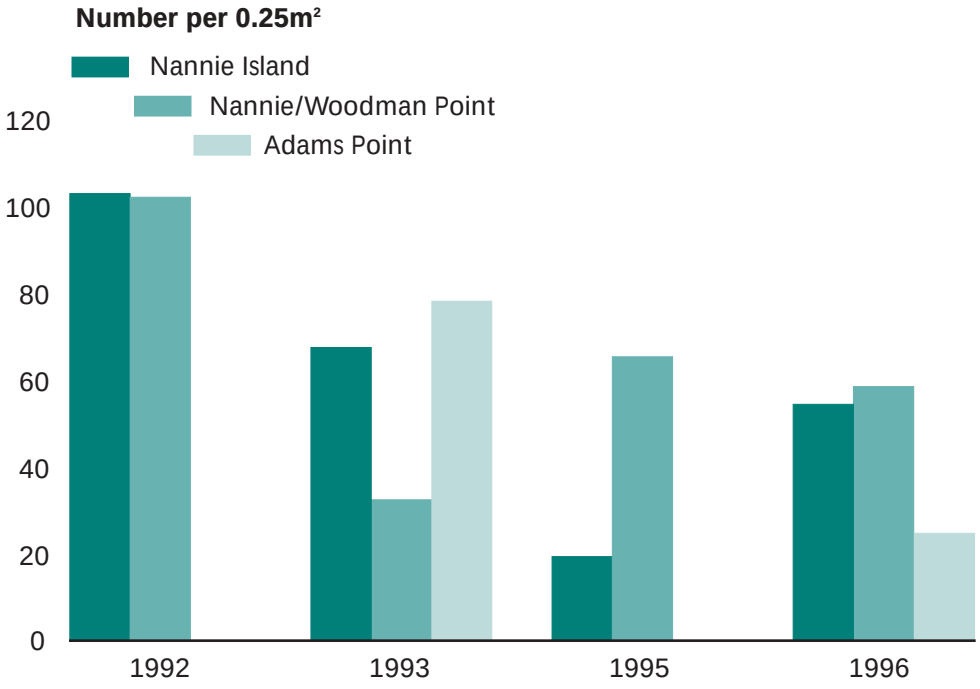
Closure of shellfish beds due to bacterial contamination is another major problem affecting shellfish and human use of shellfish resources. Shellfishing is a popular recreational activity in the state, part of the Seacoast's economic and cultural heritage. Residents from throughout the state obtain licenses and participate in recreational shellfishing. Yet over 50% of New Hampshire's

Clam Harvests in Hampton-Seabrook Harbor



Number of clam licenses and the adult clam standing crop (bushels) in Hampton-Seabrook Harbor: 1971-1987. Data from NAI (1995)

Oyster Bed Density in Great Bay: 1991-1996



estuarine waters are closed to shellfishing. These closures not only restrict popular recreational activities, but also sound an early warning of potential environmental problems.

Healthy, sustainable shellfish populations both indicate and contribute to a healthy estuarine ecosystem. Abundant shellfish communities are natural water-purifiers, enhancing water quality in the estuaries. Efforts to open shellfish beds by improving water quality will also benefit other living resources and the overall function of the estuarine ecosystem.. Water quality improvements are inextricably linked to the health and management of shellfish resources.

Steps to improve the environmental condition of New Hampshire's estuaries identified in the Water Quality, Land Use, Habitat Restoration, and Public Outreach sections of the *Plan* will contribute to improvements in shellfish resources for both human utilization and the ecological well being of the shellfish themselves. Expanding sustainable harvest of all shellfish species will bring economic and recreational benefits to the region. Expanding sustainable commercial harvest opportunities for ocean species such as the surf clam and ocean quahog, as well as expanding shellfish and finfish aquaculture opportunities, is increasingly critical as the state's fishing industry copes with reduced stocks and severe regulatory restrictions.

Harvest from some New Hampshire shellfish areas has been limited by lack of adequate monitoring to classify areas as open to harvesting. Lack of U.S. Food & Drug Administration certification is a continuing barrier to potential commercial harvest of native ocean quahogs and surf clams and to shellfish aquaculture in New Hampshire estuarine and ocean waters. Implementation of a new state shellfish program to obtain certification and coordinate planning and management activities to address these issues has already begun.

WHY IT MATTERS

Shellfish are part of the human food chain, a vital and symbolic link between people and the estuaries. Shellfish health and their wholesomeness for human consumption requires clean water. The decline in overall acreage and density of shellfish beds raises both economic and ecological concerns. Healthy shellfish populations and habitats are a high priority for NHEP, in part as a unifying outreach focus to advance the cause of clean water. Shellfish play a key role in our understanding of the interrelated web of life of the estuaries. Shellfish are a valuable resource for improving environmental quality for three reasons:

1. Shellfish are important indicators of water quality and overall health of the coastal and estuarine environments, the 'canary in the coal mine' of the estuaries. Declining shellfish populations and habitat may signal other problems in the estuarine ecosystems. Healthy populations of shellfish are also part of nature's purification system, helping to filter and clean estuarine waters. Ensuring water quality and habitat that can support healthy populations of shellfish species will also help the shellfish communities to filter and purify the water of the estuaries more effectively.
2. Shellfish are an economic, recreational, cultural, and natural resource for the Seacoast region. Recreational shellfishing in Hampton-Seabrook Harbor is estimated to contribute more than $3 million a year to the local and state economy. While no sale of shellfish is allowed, the value of oysters in major beds in the Great Bay Estuary was estimated at $3 million in 1994. A 1991 study estimated that 1,000 license-holders harvested 5,000 bushels worth $300,000 annually. However, a 1997 study estimated 661 licensed harvesters took only 2,700 bushels of oysters in 1996, reflecting the declining resource.
3. Shellfish offer an easily understood public education and awareness vehicle. Because shellfish management relies on monitoring fecal bacteria, shellfish and shellfish harvesting provide an effective illustration of the connections between sources of fecal bacteria (e.g. wastewater treatment facilities, septic systems, stormwater runoff), impaired water quality, and the availability of uncontaminated shellfish that are safe for human consumption. Observing shellfish in tide pools and along the shore, as well as harvesting and eating local shellfish, are popular and traditional parts of life on the Seacoast. Many people identify with the estuaries and coastal waters of New Hampshire and recognize shellfish, particularly softshell clams, oysters, and blue mussels, as characteristic features of the coastal environment.

Shellfish and finfish aquaculture is an issue that may hold promise for New Hampshire's economic future, particularly in view of the severe problems facing the fishing industry. Attaining FDA certification for New Hampshire's shellfish sanitation program will allow the potential development of shellfish aquaculture and commercial harvest of surf clams. Efforts are needed to effectively regulate all aspects of aquaculture in a way that simultaneously allows progress and protects the environment. However, native softshell clams and oysters will likely continue to be limited to recreational harvest. Effluent from aquaculture facilities and introduction of invasive species through shellfish or finfish aquaculture must be closely monitored to avoid adverse impacts to Great Bay and Hampton Harbor.

THE CHALLENGE

Increasing the acreage of classified and open softshell clam and oyster beds, and expanding shellfish and finfish aquaculture opportunities, are vital to the NHEP vision for New Hampshire's estuaries. Introducing commercial harvest of ocean quahogs and surf clams, both found off the open coast, is a related goal. Recreational clam licenses peaked at nearly 14,000 in 1975, but had fallen to less than 300 by the early 1990s with the closure of beds and tight harvesting restrictions due to water quality issues.

Public interest in clamming was clearly demonstrated with the rebound in licenses that accompanied the 1994 reopening of Hampton-Seabrook Harbor to harvesting. Clam license sales rose from 250 in 1993 to over 2,900 in 1994. Interest has remained high: N.H. Fish & Game estimates that 2,880 recreational harvesters took 900 bushels of clams from the Hampton-Seabrook Harbor clamflats in just 19 days open for harvesting in the 1996-97 season. The re-opening of 1,622 acres of shellfish waters in coastal New Hampshire is one of the early successes of the NHEP and its shellfish team of government agencies, scientists, and citizens.

Shellfish harvest in New Hampshire is a popular recreational pursuit. However, oyster resources in the Great Bay Estuary have declined in recent years. From 1991 to 1996 oyster density in three beds of recreational importance decreased by amounts ranging from 42% to 69%. Other oyster beds have lost significant bed acreage, especially in the Oyster and Bellamy rivers. Oyster harvests reflect these declines: a 1991 study estimated a total harvest of 5,000 bushels of oysters by 1,000 license holders, but by 1997 the estimated harvest had declined to 2,700 bushels by 661 harvesters. Predation, limited availability of suitable larvae attachment substrate, disease, harvest pressure, and a variety of management issues are likely factors in these declines.

B. PENHALE

Soft-shell clamming

New Hampshire must accomplish two major regulatory and management tasks to advance the NHEP goals for shellfish. The state needs a legitimate shellfish program with adequate state funding and staffing to meet National Shellfish Sanitation Program requirements. The state must also work in concert with Seacoast communities and individual property-owners, to resolve the water pollution sources that contribute to the high fecal coliform counts in many areas of the estuaries.

The shellfish beds are closed when treatment plants fail, pump stations overflow, and Combined Sewer Overflows discharge. *Chapter 4: Water Quality* addresses water quality improvement needs and plans for the estuaries in detail. Non-point sources of pollutants also increase with added development.

GBNERR

Chapter 5: Land Use, Development, and Habitat Protection addresses non-point source pollution through actions to limit impervious cover and sprawl, protect tidal and freshwater wetlands, groundwater, and shorelands.

The NHEP and its shellfish team determined that a new, coordinated state shellfish program was needed to more effectively increase the availability and stewardship of the state's shellfish resources. All state agencies involved in various aspects of shellfish and water quality monitoring and management were represented on the shellfish team, along with researchers from the University of New Hampshire's Jackson Estuarine Laboratory and interested citizens. From these discussions, the NH Department of Environmental Services spearheaded a collaborative, inter-agency effort to develop and obtain resources for a restructured shellfish sanitation program, which is outlined in Action SHL-1. Implementation of the seven-year plan began in 1999 when the Legislature reassigned authority for shellfish sanitation to NH DES. However, NH DES has secured resources for this program only for the short term. Long term, stable funding remains an issue.

The New Hampshire Estuaries Project has identified information gaps related to shellfish and the stresses they are under in New Hampshire's estuaries. More research and monitoring is needed to ensure the shellfish resources of coastal New Hampshire are managed sustainably. The public, particularly shellfish harvesters, can help protect and enhance shellfish populations and vitality – or harm these valuable resources. Education and outreach efforts are planned to inform members of the public how they can have a positive impact on shellfish resources as active shellfishers, shoreline property owners, or as residents of the Great Bay and coastal watersheds.

REGULATORY AND MANAGEMENT PROGRAMS

Regulation and management of shellfish resources involves two distinct aspects:

1. Sanitation monitoring and regulation to ensure human health and safety;
2. Resource management to assure sustainable harvest of healthy shellfish.

The U.S. Food and Drug Administration (FDA) oversees the National Shellfish Sanitation Program (NSSP), a program to regulate the commercial shellfish industry. The NH Department of Health & Human Services (NH DHHS) has handled sanitary management at the state level, but in 1999 the state Legislature enacted legislation to reorganize the state's shellfish sanitation efforts, with the NH Department of Environmental Services (NH DES) taking the lead. (See Action SHL-1 in the Shellfish Action Plans for details of the new state shellfish sanitation program.) The National Marine Fisheries Service manages oceanic shellfish resources under the Magnuson Fisheries Conservation and Management Act, but resource management of estuarine shellfish fisheries is primarily under state control through the NH Fish & Game Department (NH F&G).

Unlike some states, local governments in New Hampshire have no regulatory authority over shellfish harvesting or licensing. Municipalities do play an important role in controlling water pollution sources that impact shellfish health and safety through land use and stormwater management and wastewater treatment systems. NH DES has also had an indirect role in shellfish management through its role in protecting water quality.

EPA published new regulations on December 8, 1999 for Phase II of the NPDES permit stormwater management program. Compliance with these Phase II rules will be required by March 2003. Under Phase II rules, NPDES permit coverage will be required for small municipal separate storm sewer system discharges in urbanized areas--including Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, Rye, and Somersworth. Phase II NPDES stormwater rules will also apply to discharges from construction sites disturbing between one and five acres.

Clean Water Act Section 303(d) and its implementing regulations require states to list water body segments as impaired if they fail to comply with a water quality goal or use (such as fishing or swimming) even after targeted pollution control practices have been put into place. The Clean Water Act requires that this impaired waters list include a prioritized ranking of segments most in need of Total Maximum Daily Load (TMDL) analysis. The TMDL defines the maximum amount of a specific pollutant that can be discharged into a body of water without violating water quality goals for that water. NPDES permits and state wastewater discharge licenses are written to be consistent with the TMDL waste load allocations for the receiving water body. TMDLs are being developed and implemented for the Rochester segment of the Cocheco River for dissolved oxygen, the Salmon Falls River downstream of Somersworth for dissolved oxygen and phosphorous, and the Lamprey River in Epping for dissolved oxygen and phosphorous.

Although FDA has no authority over recreational harvesting, New Hampshire state law (RSA 485-A8, v) mandates following NSSP guidelines in the management of tidal waters used for growing or taking of shellfish. FDA has not found the state to be in full compliance with all NSSP requirements. This has limited or prohibited commercial shellfish harvesting and shellfish aquaculture in the state.

Coastal New Hampshire has benefitted from the application of the federal standards. Following NSSP guidelines for water quality monitoring and sanitary survey protocols, state agencies partnering with the NHEP recently re-opened productive shellfish areas for recreational harvesting while adequately addressing public health concerns.

New Hampshire must accomplish two major regulatory and management tasks to advance the NHEP goals for shellfish:

1. The state needs a legitimate shellfish sanitation program with adequate state funding and staffing to meet NSSP requirements.
2. The state and municipalities must continue to identify and eliminate pollution sources, particularly sources of fecal coliform bacteria that are degrading the water quality of the estuaries and limiting the potential for recreational and commercial harvest and commercial cultivation of shellfish.

SHELLFISH RESOURCES: GOALS FOR ECOLOGICAL AND RESOURCE HEALTH

The Action Plans for shellfish resources address sanitary, ecological, and resource management of shellfish; aquaculture and commercial harvest of shellfish; and public outreach and education efforts. See *Appendix 3* for a complete list of goals and objectives for shellfish resources.

- Achieve sustainable shellfish resources by tripling the area of shellfish beds that are classified open for harvesting to 75% of all beds, and tripling the quantity of harvestable clams and oysters in New Hampshire's estuaries.
- Assure that shellfish are fit for human consumption, and support a healthy marine ecosystem.
- Provide opportunities and strategies for restoration of shellfish communities and habitat.
- Support coordination to achieve environmentally sound shellfish aquaculture activities.
- Ensure that communities, government agencies, organizations, and individuals actively participate in achieving the shellfish-related goals for New Hampshire's estuaries.

SHELLFISH RESOURCES
ACTION PLANS

ACTION SHL-1

Implement procedures in the National Shellfish Sanitation Program guidance to gain certification by the FDA for a recreational and commercial shellfish program.

PRIORITY
+++ SHELLFISH SANITATION MANAGEMENT

BACKGROUND

Although the New Hampshire shellfish sanitation program adheres to the federal guidelines, the program has never been legally certified by the FDA. This lack of certification has stymied the efforts of commercial ventures (limited wild-stock harvest of selected species such as surf clams or quahogs, and commercial aquaculture of species such as oysters and mussels).

The purpose of this Action Plan is to continue implementing the steps needed to create an FDA-certified shellfish program. FDA certification would give the state the option of approving commercial shellfish operations in selected coastal waters. Steps taken to date to gain FDA certification include establishing an NHEP-coordinated shellfish/living resources working group, the hiring of a full-time shellfish sanitation program staff person, and 1999 legislation changing state agency regulatory authorities for the shellfish program from NH DHHS to NH DES. Using the strong agency partnerships and the involvement of the working group, this Action Plan calls for completing the required steps to apply for FDA certification.

ACTIONS/ACTIVITIES

1. The state agencies will work together to address comments raised previously by the FDA concerning deficiencies in New Hampshire's shellfish program. Much of this action has been accomplished during the 1999-2000 transition period when certain authorities and responsibilities are transferred from the NH Department of Health and Human Services (NH DHHS) to the NH Department of Environmental Services (NH DES). Staff funding sources will be investigated and pursued.
2. All pertinent rules and regulations will be reviewed for consistency with federal requirements, and new rules and regulations will be drafted as necessary.
3. The partnering agencies will draft and agree upon the necessary memoranda of agreement required by the FDA and state law.
4. NH DES and NH DHHS has submitted an application to the FDA after review and approval by the NH Fish and Game Department and the NHEP Shellfish/Living Resources working group.
5. NH DES will be responsible for implementing the Schedule of Growing Area Work 1999- 2005 (see schedule below), including any modifications agreed upon during the transition period.

RESPONSIBLE PARTIES

NH Department of Environmental Services is the lead agency responsible for implementing and coordinating this Action Plan (Steps 1-5), with assistance from NH Department of Health and Human Services, NH Fish and Game Department, and NH Estuaries Project.

IMPLEMENTATION LOCATION

See “Schedule of Shellfish Growing Area Work: 1999-2005” in Timetable section below for specific locations.

COSTS

Base NH DES shellfish program costs are estimated at approximately $150,000 per year (Step 5). Sanitary survey costs for specific areas can range from $30,000 to $100,000 depending on location (Step 5).

FUNDING

Funding for two NH DES staff assigned to the NH DES Shellfish Sanitation Program is secure for 2000-2001. NHEP and DES are pursuing state funding for the staff positions (see SHL-4). Assistance from existing staff in other state agencies will also support this action. NHEP implementation funds will be applied to program functions in 2001-2002, and potentially through completion of sanitary survey schedule outline on pages 6-14.

REGULATORY NEEDS

FDA compliance may require some administrative rules and legislative changes.

EXPECTED BENEFITS

The state will have a long-term, effective shellfish program supported by cooperating state agencies to safeguard public health for the consumption of shellfish. This will enable commercial harvesting of soft-shell clams, oysters, and other shellfish. Intensive sanitary surveys of growing areas will result in identification of pollution sources and elimination of water quality problems.

MONITORING AND ENFORCEMENT

The monitoring of shellfish waters and pollution sources is a large but achievable task. NH DES and NHEP have proposed an aggressive monitoring schedule to achieve maximum acreage of open shellfish waters. NH F&G is a proven effective enforcement agency, but details for patrolling shellfish growing areas by NH F&G need to be worked out.

TIMETABLE

Steps 1-4 were initiated and NH DES submitted an application to FDA (Step 4) in December 2000.

Schedule of Shellfish Growing Area Work: 1999-2005 (Step 5)

The following schedule for the shellfish growing area work was developed by the New Hampshire Estuaries Project, based on previous work by the UNH Jackson Estuarine Laboratory. It was modified by the NH Department of Environmental Services to reflect the pollution source elimination work.

The criteria used to set this schedule are listed below in order of priority.

- Scheduling sanitary survey updates to meet the three year schedule required by the National Shellfish Sanitation Program.
- Meeting commitments tied to the use of the funding announced in July 1998 by Vice President Al Gore, for Little Harbor/Back Channel, Hampton-Seabrook Harbor, and Bellamy River.
- Geographically synchronizing shoreline surveys.
- Accommodating the expressed priorities of the NHEP Shellfish/Living Resources Team.

DEFINITIONS OF PROJECT TYPE

Full sanitary survey means the completion of a shoreline survey; evaluation of any meteorological effects, hydrographic influences, and geographic characteristics that may affect the distribution of pollutants over the growing area; and analysis of the results of routine bacteriological water sampling.

Sanitary survey update means a reevaluation, every third year, of all pollution sources identified in the sanitary survey and documentation of newly identified sources with effect on the growing area evaluated. Also included is an analysis of the results of routine bacteriological water sampling.

Pollution source elimination means comprehensive investigations of the identified pollution sources and actions taken to eliminate the source or control the impact to the growing areas.

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PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, although completion of this action will enhance implementation of Action SHL-1

SHELLFISH PROGRAM SCHEDULE

Area	1999	2000	2001	2002	2003	2004	2005
HAMPTON/SEABROOK (H/S)							
H/S Harbor	PSE	SSU	PSE		SSU	PSE	
H/S Tributaries	PSE	SS	PSE		SSU	PSE	
COASTAL							
Atlantic Coastline	SS	PSE		SSU	PSE		SSU
Rye Harbor	SS	PSE		SSU	PSE		SSU
PORTSMOUTH AREA							
Little Harbor/Back Channel	SS	PSE		SSU	PSE		SSU
Lower Portsmouth Harbor						SS	PSE
Upper Portsmouth Harbor						SS	PSE
Lower Piscataqua River						SS	PSE
GREAT BAY ESTUARY							
Great Bay SSU	SSU			SSU	PSE		SSU
Upper Little Bay	SSU			SSU	PSE		SSU
Lower Little Bay			SSU	PSE			
Upper Piscataqua River			SS	PSE		SSU	PSE
GREAT BAY TRIBUTARIES							
Salmon Falls River			SS	PSE		SSU	PSE
Cocheco River			SS	PSE		SSU	PSE
Bellamy River	PSE	PSE	SS	PSE		SSU	PSE
Oyster River			SS	PSE		SSU	PSE
Lamprey River					SS	PSE	
Squamscott River					SS	PSE	
Winnicut River				SS	PSE		SSU

SS: Sanitary Survey
SSU: Sanitary Survey Update
PSE: Pollution Source Elimination

ACTION SHL-2

Identify sources, and reduce or eliminate contaminants in the New Hampshire estuarine watersheds.

PRIORITY

SHELLFISH SANITATION MANAGEMENT

See Chapter 4:
Water Quality Goals for New Hampshire's Estuaries

To ensure New Hampshire's shellfish resources are healthy, and that shellfish habitat water quality is sufficient for sustainable harvest without undo risk to public health, pollution sources throughout the estuarine watersheds must be identified, reduced, or eliminated. Strategies to identify, reduce, and eliminate pollution sources in coastal New Hampshire are developed in detail throughout Chapter 4: Water Quality. Nearly all water quality improvements achieved through the actions in Chapter 4 will benefit New Hampshire's shellfish resources.

SHELLFISH SANITATION MANAGEMENT

PRIORITY

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ACTION SHL-3

Institute land-use practices in the New Hampshire Estuaries Watersheds that improve water quality and shellfish habitat.

See Chapter 5: Land Use Goals for New Hampshire Estuaries.

To ensure new hampshire shellfish resources are healthy, and that shellfish habitat water quality is sufficient for sustainable harvest without undo risk to public health, land-use practices must not degrade water quality and estuarine habitats. Chapter 5: land use, development, and habitat protection develops detailed strategies to restrict or eliminate land-use practices that adversely affect estuarine habitats.

ACTION SHL-4

Enhance the amount and reliability of funding for strategies and actions to maintain a comprehensive shellfish program.

PRIORITY
+++
SHELLFISH SANITATION MANAGEMENT

BACKGROUND

Funding for a NH shellfish program to classify and monitor shellfish-growing areas has been neither stable nor adequate over the years, resulting in the closure of many areas to harvesting. The lack of a stable program has also precluded development of commercial shellfish aquaculture operations – which could generate some funding to support the evaluation of recreational harvest areas.

Shellfish program funding and staff have been patched together from state and federal sources since the early 1990s. While this approach resulted in reopening some shellfish beds, it does not provide long-term stability for the program. Without such stability, periodic monitoring and assessment of shellfish waters will be inadequate. The result will be:

- Closure of shellfish areas that are currently open for harvesting
- Continued closure of shellfish areas that are currently closed for harvesting
- Fewer pollution sources identified and eliminated through shellfish sanitary surveys
- Continued difficulty in establishing shellfish aquaculture operations

ACTIONS/ACTIVITIES

Funding for a fully staffed shellfish sanitation program has been secured for the first two years of implementation of the *NHEP Management Plan*. The New Hampshire General Court (Legislature) will be approached to secure state funding for the program beyond the first two years.

RESPONSIBLE PARTIES

NH DES is responsible for securing the necessary funding with assistance from the NH Estuaries Project.

IMPLEMENTATION LOCATION

Not applicable

COSTS

Base funding for a shellfish sanitation program is estimated at $150,000 per year. Additional costs to conduct sanitary surveys in specific shellfish growing areas vary with location (costs typically range from $30,000 to $100,000). Cost estimates for specific growing areas are currently being developed.

FUNDING

Funding will be sought for state funds (e.g., the state general fund). Other potential sources could include proceeds from an increase in shellfish license fees, aquaculture license fees, etc.

REGULATORY NEEDS

A state appropriation and possible changes to laws on state license fees may be required.

EXPECTED BENEFITS

A stable shellfish program will enable the state to fully comply with National Shellfish Sanitation Program guidelines, allowing the state to reopen some beds currently closed, keep currently open beds in their open status, and permit commercial shellfish aquaculture.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Highest Priority action will be initiated in 2000-2001.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION SHL-5

Regularly collect and monitor water quality samples to identify sources and reduce or eliminate contaminants.

PRIORITY
+++

SHELLFISH SANITATION MANAGEMENT

Implemented by Shellfish Action SHL-1

The National Shellfish Sanitation Program guidance requires a comprehensive water quality monitoring program, as proposed in Action SHL-1 (see the work plan for 1999-2005 in SHL-1). This monitoring program will provide the basis for making shellfish harvesting and management decisions in the interests of both public health and environmental quality of the shellfish resource. A comprehensive water quality monitoring program will also provide a valuable gauge of overall water quality in the estuaries.

SHELLFISH SANITATION MANAGEMENT

PRIORITY
+++

ACTION SHL-6

Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins.

BACKGROUND

Monitoring for toxins and biotoxins in shellfish waters is required by the National Shellfish Sanitation Program guidelines. The state's current monitoring program for Paralytic Shellfish Poison (PSP), commonly referred to as "red tide," involves collecting mussels on a weekly basis from April to October at one Hampton-Seabrook Estuary site. New Hampshire and neighboring states share data readily to track the occurrence and movement of red tide blooms in the Gulf of Maine. The state shellfish control authority did not historically assess other toxic substances (e.g., heavy metals) in shellfish waters in a comprehensive manner. However, numerous coastal NH studies and monitoring programs, including NH Department of Environmental Services, currently generate information on toxins in sediment, fish tissue, shellfish tissue, and other media (the GulfWatch program's monitoring of mussel tissue for toxic substances is one example). Furthermore, sites that have the potential for releasing toxic substances to the environment are evaluated during sanitary surveys of specific shellfish growing areas.

ACTIONS/ACTIVITIES

Develop a more comprehensive monitoring program for toxic assessment of shellfish tissue and biotoxin monitoring. This program should build on existing PSP and toxin monitoring programs. The National Shellfish Sanitation Program requires assessment of the presence of toxic substances in shellfish meats, but management of this assessment on the state level needs additional development. The new program should:

1. Consider an additional PSP collection site, possibly on the Atlantic Coast, to augment the current Hampton-Seabrook Estuary site.
2. Support the development of a volunteer biotoxin-monitoring program. Both shoreline and boat stations should be considered.
3. Work with the GulfWatch Program to establish and share permanent monitoring sites in suspect areas for toxic substances, including heavy metals (mercury and lead are primary contaminants of importance) and chlorinated hydrocarbons. In addition, NH DES should develop and adopt protocols for determining the presence and extent of toxic contamination around marinas.
4. Consider using surf clams in addition to mussels in the evaluation of PSP and/or toxic substances.
5. Monitor soft-shell clams and oysters for toxic contamination.

RESPONSIBLE PARTIES

NH Department of Environmental Services is primarily responsible (Steps 1-5), with additional involvement by the UNH Jackson Estuarine Laboratory (possibly through doctoral programs) (Steps 1, 2, 4) and local volunteer monitoring groups (Step 2).

IMPLEMENTATION LOCATION

The new PSP monitoring location is at the Isle of Shoals (Step 1). Clam and oyster beds will be monitored on a rotational basis in Great Bay, Hampton Harbor, and the tidal tributaries (Step 5).

COSTS

New PSP monitoring site in Step 1	
Analytical Costs per year	$6,200
Sampling and transportation costs per year	$2,300
Setting up a volunteer PSP monitoring program in Step 2	
Cost for a program with four monitoring sites	$18,000
Working with GulfWatch to collect and analyze	
mussel tissue for toxic substances in Step 3	
Costs per site for analysis per year	$2,240
Monitor clams and oysters annually in Step 5	$5,000

FUNDING

Steps 1 and 3 will be funded with NHEP implementation funds in 2000-2002. Step 5 will be funded with NHEP implementation funds as a component of the NHEP monitoring program on an ongoing basis. Additional money may be available through other appropriate federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH Fish and Game, NH DES and NH OSP could also support this action.

REGULATORY NEEDS

Possible adoption of administrative rules for sampling and analytical protocols.

EXPECTED BENEFITS

Protection of human health for those that consume shellfish.

MONITORING AND ENFORCEMENT

No enforcement required.

TIMETABLE

This Highest Priority was initiated in 2000 and will be ongoing.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY +++

ACTION SHL-7

Maintain an ongoing shellfish resource assessment program focusing on softshell clam and European and American oysters, but also considering blue mussels, sea scallops, surf clams, ocean quahogs, and razor clams.

BACKGROUND

The New Hampshire coast and estuaries support populations of molluscan shellfish, including European and American oysters, blue mussels, sea scallops, softshell clams, surf clams, ocean quahog, and razor clams. These species are ecologically important, and are all harvested recreationally, and in some cases commercially (currently commercial use is limited to a small harvest for scallops, and harvest of other species for bait).

Molluscan shellfish are subject to many natural and anthropogenic influences that affect their abundance and population structure. Recruitment of young of the year shellfish depends on adult spawning success, larval survival, and post-metamorphosis survival. The success of these stages depends on temperature, salinity, food quantity and quality, availability of preferred substrates, sedimentation, predator density, and inadvertent harvest-related mortality. Juvenile and adult populations are affected by natural pressures such as predation, disease, prolonged temperature and salinity extremes, and harmful algal blooms, in addition to human influences such as harvest pressure and pollutants.

Effective resource management requires an understanding of the spatial distribution, abundance, and age structure of shellfish species, and how these change over time. Regulatory actions can minimize or prevent harvest at times and in locations where stocks are depressed, and education efforts can encourage harvest at times and locations where harvestable size shellfish are abundant. Assessment programs to identify the locations of shellfish resources and track their status and trends over time should be maintained for species for which there is historical data, and initiated for others.

ACTIONS/ACTIVITIES

1 NH Fish and Game, in consultation with local fishermen, the UNH Jackson Estuarine Laboratory (JEL), and other constituents, should develop a five-year strategic plan and assessment schedule, including the species to be assessed, locations, and assessment interval (e.g. annual, bi-annual, etc.), and time of year. This plan should include a schedule of what, where, and how an area is to be surveyed, what additional areas should be added, and identify the amount and potential sources of funding needed for each year's activity.

Routine sampling is being conducted in the Great Bay Estuary by the NH Fish and Game Department, and in Hampton-Seabrook Harbor by Normandeau Associates Inc. (NAI) under a requirement of the Seabrook Station NPDES permit. UNH and other scientific contractors would conduct studies in Little and Rye Harbors, near-shore coastal areas, and Back Channel on a two-year cycle or longer, depending on availability of funds.

2 Establish standardized sampling protocols to make valid year-to-year comparisons. For species under ongoing assessment, all parties should agree to use existing procedures (e.g., NHF&G standard population sampling protocol) when appropriate. Sampling methodology should be developed for species that have not been subject to assessment. This could be accomplished in a meeting of the three groups (NHF&G, JEL, and NAI).

3 Establish a data management and reporting protocol and ensure data distribution. This could also be accomplished with a meeting of the three groups (NHF&G, JEL, and NAI).

4 Evaluate natural (e.g., disease) and human (e.g., harvest pressure) influences on population changes. This should be done cooperatively with NHF&G and the scientific community.

5 Ensure that results are reported to other agencies, especially to those agencies charged with scheduling and conducting surveys to determine if specific shellfish areas can be opened for harvest.

RESPONSIBLE PARTIES

New Hampshire Fish and Game will be the lead agency responsible for the implementation and coordination of this action (Steps 1-5) with assistance from NAI, JEL, and other contractors that have been granted scientific permits by NH Fish and Game.

IMPLEMENTATION LOCATION

The resource plan will address shellfish resource issues throughout New Hampshire estuaries and the near-shore environment based on existing or potential habitat for molluscan shellfish, including European and American oysters, blue mussels, sea scallops, softshell clams, surf clams, ocean quahog, and razor clams.

COSTS

New costs (i.e. those beyond the existing assessment programs) will range from a minimum of $3,000 up to $30,000 annually, depending on the workplan (Steps 1-5).

FUNDING

NHEP implementation funds will be applied to Steps 1-3 in 2001-2002. NHEP monitoring staff will assist with Steps 3-5 in 2001-2003. New funding sources, if needed, should augment that currently provided by NHF&G, Seabrook Station, and NHEP. Additional sources could include state and federal agencies such as UNH Sea Grant, NH Coastal Program, National Marine Fisheries Service, and the Great Bay National Estuarine Research Reserve.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

An adequate shellfish resource assessment program will help the state to manage shellfish more effectively to ensure a healthy, sustainable resource.

MONITORING AND ENFORCEMENT

NH Fish and Game and the scientific community should be responsible for monitoring and reporting on progress. Reports should go to Fish and Game, which would then discuss any recommendations with the Advisory Committee for Shore Fisheries, and to the state shellfish sanitation agency (NH DES) and its advisory committee.

TIMETABLE

This Highest Priority action will be initiated in 2001 and will be a component of the NHEP monitoring program.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION SHL-8

Develop and implement a plan for shellfish resource enhancement and habitat restoration activities to achieve a sustainable resource contributing to a healthy environment.

PRIORITY
+++

SHELLFISH RESOURCE MANAGEMENT

BACKGROUND

A number of factors can contribute to declines in shellfish populations including siltation, disease, predators, invasive species, lack of suitable substrate, and over-harvesting. Shellfish beds may recover on their own over time, but some may never recover, resulting in loss of habitat value, ecosystem function, and recreational opportunities. Many of Great Bay's oyster beds (Adams Point, the Bellamy, Salmon Falls, Oyster, and Piscataqua Rivers, and southwest Great Bay) have experienced dramatic declines in size of area, abundance, and recruitment of oysters in recent years, and clam beds that were once productive have very low numbers of clams.

Many technologies and methods practiced in commercial shellfish culture can be applied to public resources to benefit recreational harvesting and habitat structure and function. Enhancement of public shellfish resources would benefit the recreational shellfishing community. Shellfish restoration would also provide important habitat for invertebrates and fish, and improve water quality by enhancing filtration capacity. Areas where resource enhancement and habitat restoration are needed should be identified, and a plan to implement specific activities developed.

ACTIONS/ACTIVITIES

1 NH F&G or contractor will develop a strategy to use aquaculture technologies for shellfish resource enhancement and habitat restoration. Resource enhancement could involve the following steps:

- Identify areas where enhancement is needed The UNH Jackson Estuarine Laboratory is completing this study with NHEP funding.
- Remove silt from oyster beds during spawning closure periods
- Remove mussels from clamflats
- Support demonstration projects for preparing substrate for clam settlement
- Produce educational material on returning oyster shell to the beds and distribute with licenses
- Create shell deposit areas and redistribute accumulated oyster shells in July
- Consider a rule change to allow on-site shucking of oysters (intended to encourage the return of shell to the beds to increase larval settling sites)
- Consider hatchery seed for clams and disease-resistant seed for oysters
- Educate the public on the benefits of healthy shellfish beds

2 Restoration could involve the following step:

- Identify areas where restoration is needed, and prioritize with input from the public and other interested entities.

3 NH F&G or contractor will determine and implement appropriate technology (similar to activities described above, but may also include new or other methods and technology)

Consider methods such as opening and closing beds based on the amount of resource available, and managing habitat on an ongoing basis (pursuing this option will require enforcement and education efforts). Resource enhancement or restoration could be conducted by NH F&G, or a NH F&G-permitted entity, in Great Bay, Hampton-Seabrook Harbor, and Little Harbor.

RESPONSIBLE PARTIES

New Hampshire Fish and Game, JEL, and other entities granted permits by NH F&G (Steps 1-3).

IMPLEMENTATION LOCATION

Resource enhancement or restoration could be conducted in Great Bay, Little Bay, Hampton- Seabrook Estuary, Little Harbor, and in selected locations in estuarine tributary rivers.

COSTS

The NHEP funded a report in 1999 which identifies locations for enhancement and restoration activities. Resource enhancement costs can range from $3,000 to $50,000 per site. Restoration Costs in the Great Bay tidal rivers can range from $10,000 to $50,000 per site.

FUNDING

NHEP will apply $40,000 in 2001-2002 to shellfish restoration activities. Projects could be funded by NH F&G, grants from NH Coastal Program, NH Estuaries Project, UNH Sea Grant, CICEET and other appropriate federal programs as identified in tables 10.1 through 10.6 of this document.

REGULATORY NEEDS

A rule change would be needed to allow on-site shucking.

EXPECTED BENEFITS

Habitat restoration and enhancement will provide greater opportunities for shellfish harvest, provide water quality benefits from shellfish filter-feeding, and increase habitat productivity in the ecosystem.

MONITORING AND ENFORCEMENT

NH Fish and Game, the scientific community, and constituents could be responsible for monitoring efforts. Management through opening and closing of beds would require enforcement and education activities. All progress reports, concerns, and recommendations on resource enhancement and restoration by the scientific community and interested groups and individuals would be reported to NH Fish and Game, who will communicate on these issues with the Advisory Committee for Shore Fisheries.

TIMETABLE

This Highest Priority action will be initiated in 2001-2002.

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

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ACTION SHL-9A

Decrease shellfish resource depletion and increase productivity with stricter state penalties for illegal harvesting.

BACKGROUND

Illegal harvesting is a problem for resource managers of New Hampshire's shellfish. The most prominent examples of this are probably the out-of-season, over-limit, and non-approved area taking of clams at the Hampton-Seabrook Estuary. Deterrence of illegal shellfish taking is being addressed by law enforcement vigilance. Apprehending shellfish poachers and the issuance of citations for rule violations is just one facet of the total effective control against this type of illegal activity. Equally important is the penalty imposed by the judicial system for poaching violations.

The NH Fish and Game Department considers the current penalty of $58.50 per quart of clams taken in excess of the 10-quart limit, with a misdemeanor charge if the infraction is more than a bushel or if clams are taken between sunset and sunrise, to be adequate. However, some people think that current court-imposed penalties prescribed by law are too low.

ACTIONS/ACTIVITIES

1. Monitor the effectiveness of the penalties for shellfish harvesting violations (NH F&G).
2. Formulate recommendations for increased penalties if deemed necessary. The executive director of NHF&G may recommend an increase in penalties up to a maximum of $100 per quart, if warranted.

RESPONSIBLE PARTIES

The NH Fish and Game Department is the law enforcement agency for shellfish harvesting (Step 1). NH Fish and Game will also monitor and assess the effectiveness of the current system of penalties for shellfish harvesting violations, making recommendation for changes as warranted (Step 2).

IMPLEMENTATION LOCATION

The Hampton-Seabrook Estuary is considered the site of most illegal shellfish harvesting activities.

COSTS

Costs are estimated to be minimal, since these activities are part of NH Fish and Game Department standard enforcement procedures.

FUNDING

Funding for these activities is already in place at NH Fish and Game.

REGULATORY NEEDS

Possible change in the law to increase the poaching penalty.

EXPECTED BENEFITS

Actions are expected to decrease the illegal taking of shellfish and increase the number of harvestable clams and oysters in New Hampshire.

MONITORING AND ENFORCEMENT

The New Hampshire Fish and Game Department will implement and monitor the results, and report on progress. All enforcement activities to be conducted by NH Fish and Game.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

+

ACTION SHL-9B

Decrease shellfish mortality and increase productivity through outreach and education about methods to control shellfish predators.

BACKGROUND

Both of New Hampshire's principal recreational shellfish species – American oyster *(Crassostrea virginica)* and softshell clam *(Mya arenaria)* – are subject to predation by a wide variety of marine invertebrates. Much of this natural predation occurs on very small size classes which do not yet have heavy protective shells.

Classic examples of these predators are the oyster drill *(Urosalpinx cinerea)*, which is a boring snail, and the green crab *(Carcinus maenas)*, an introduced species that consumes small clams. Green crab assessment is ongoing by NH F&G. Oyster drill abundance is calculated annually with oyster resource surveys. Other predators may also affect populations, depending on the location of oysters and clams. Identifying all possible predators for these two recreationally valuable shellfish may be useful, but is probably less important than focusing on well-known primary predators.

Strategies to reduce known predators such as the oyster drill and green crab may help reduce mortality of young clams and oysters. These strategies can be extended to other predators as they are recognized.

ACTIONS/ACTIVITIES

1. Prepare and disseminate a press release to educate the public about the predators of harvestable shellfish.
2. Develop a brochure for shellfishing license-holders on identifying predators and their egg cases, and how to remove them.
3. Encourage the harvest of predators such as green crabs for bait.
4. Assess the need for a program to track the relative abundance of selected shellfish predators.

RESPONSIBLE PARTIES

NH Fish and Game Department will be the lead agency in this educational effort (Steps 1-4).

IMPLEMENTATION LOCATION

43 coastal communities.

COSTS

Producing the brochure and press release would cost $5,000. Some savings could be realized by including this information in the informational materials distributed by NH Fish and Game with the purchase of a NH Shellfish license.

FUNDING

This action may be funded through US EPA NHEP implementation funds or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH Fish and Game and NH OSP could also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

These activities are expected to affect the shellfish beds of the Great Bay Estuary and the Hampton-Seabrook Estuary. They may increase the number of harvestable clams and oysters in New Hampshire by educating license-holders about shellfish predators and encouraging them to remove these predators.

MONITORING AND ENFORCEMENT

No monitoring or enforcement is needed.

TIMETABLE

Step 1 was initiated in 2000 by including information on predators in the Recreational Saltwater Fishing Guide produced by NH F&G. Step 4 is an ongoing activity at NH F&G to assist green crabs.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

+

ACTION SHL-9C

Decrease shellfish mortality and increase productivity through the investigation of alternative recreational harvest methods.

BACKGROUND

Clams and oysters are harvested recreationally in New Hampshire only by certain prescribed methods. Clams may be dug by hand or with a hand-held tool with a handle not exceeding 18 inches. Oysters may be taken only by hand or by hand tongs. In actual practice oyster harvesters wade in shallows and hand-pick or use a slightly modified rake. In deeper water harvesters take oysters by diving or use of oyster tongs.

Resource managers are concerned about collateral damage to non-target shellfish – typically breakage of undersize oysters or clams during legal taking. While the currently allowed harvest methods are reasonably protective of the resource, some non-target sizes may be inadvertently damaged. Investigation of less damaging methods may reduce losses of under-sized clams and oysters.

ACTIONS/ACTIVITIES

1. Upon request, the NH Fish and Game Department will provide information on obtaining a scientific permit for controlled experiments designed to evaluate alternate harvest methods.
2. These alternate methods will be evaluated by NH F&G and the Advisory Committee on Shore Fisheries.

RESPONSIBLE PARTIES

NH F&G (Steps 1-2) would be responsible for issuing permits and reviewing research findings. Entities granted scientific permits by NH F&G to research this issue are responsible for creating an experimental design that addresses the resource concerns posed in this Action Plan.

COSTS

The cost for issuing permits and evaluating experimental results would be absorbed by the existing NH F&G budget. Costs for the actual experiments cannot be estimated until specific proposals are developed by interested entities.

FUNDING

Funding for the permitting and review portion of this action is already provided by NH F&G.

REGULATORY NEEDS

None anticipated, unless alternative methods are identified that require regulatory changes specified by law.

EXPECTED BENEFITS

An increase in the number of harvestable clams and oysters in New Hampshire through the implementation of less damaging harvesting methods for shellfish.

MONITORING AND ENFORCEMENT

The NH Fish and Game Department will implement and monitor the results, and report on progress.

TIMETABLE

Initiate by 2007 or as research proposals are made.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

+

ACTION SHL-9D

Increase productivity by discouraging the harvest of immature shellfish.

BACKGROUND

Size limits are a very common method of managing many fishery resources. Conventional wisdom holds that allowing year classes of young to survive to reproductive maturity and activity will increase chances for a sustainable and even burgeoning stock. The concept of spawning stock biomass has long been a general index of stock health.

A heavily exploited resource will show a nearly continuous decline in average size of catch as time passes. Left unchecked, catches could tend to include more individuals not yet sexually mature, depriving the stock of future recruits into the spawning stock biomass, and diminishing overall stock reproductive potential. For these reasons individual size limits usually reflect some knowledge of the species reproductive biology and the size at which sexual maturity is attained.

Shellfish species of interest to New Hampshire coastal recreational harvesters are the American oyster *(Crassostrea virginica)* and the softshell clam *(Mya arenaria)*. State regulations for harvest of these two species do not include size limits.

Size limits for oysters have not been imposed because the natural settlement and cementing of oyster spat on existing live oyster shell creates an unenforceable condition. It would be nearly impossible to expect the harvester to closely inspect and remove small spat or even yearling oysters from those taken. Complicating this still further is the likelihood that attempting to remove small oysters would result in their destruction. Clams are perhaps a more likely candidate because they exist in solitary burrows in the substrate. It is conceivable that a digger would be able to take only those of a certain size and larger.

Previous public hearings on this subject have shown the public views the ability to take smaller clams as an important option. However, it may be appropriate to try an educational program to persuade diggers over a period of time to voluntarily take mature specimens and leave the immature ones.

ACTIONS/ACTIVITIES

A brochure could be developed, or information included in a comprehensive brochure given to license-holders, encouraging resource enhancement by returning oysters with small spat or yearling oysters, and not harvesting clams smaller than two inches in length. A comprehensive brochure could incorporate information already distributed in the form of a flier on the proper digging of clams.

RESPONSIBLE PARTIES

The New Hampshire Fish and Game Department.

COSTS

The educational brochure could be funded by state or federal funding, estimated cost $5,000.

FUNDING

This Action Plan may be funded through US EPA NHEP implementation funds or through other appropriate federal programs identified in Tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH F&G, NH DES, and NH OSP could also support this action

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

More knowledgeable recreational harvesters will help maintain a healthy, sustainable resource, contributing to a healthy environment.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH OUTREACH

PRIORITY
+++

ACTION SHL-10

Provide information regarding public access to shellfish beds through distribution of maps/booklets.

BACKGROUND

The state of New Hampshire is currently in the process of classifying and opening additional shellfish beds for recreational harvesting of clams and oysters. A map showing the locations of these resources and how to access these locations would be helpful for both resource managers and the general public.

New Hampshire Fish and Game's current efforts in outreach publications pertaining to recreational shellfish beds include a map, *New Hampshire Boating and Fishing Public Access Map;* two brochures, *New Hampshire Recreational Saltwater Fishing Guide* and the 1999 *New Hampshire Saltwater Fishing Digest;* and a flier on the proper digging of softshell clams. To supplement these informational publications, NH Fish and Game, with assistance from the UNH Jackson Estuarine Laboratory and the Office of State Planning, will record new locations of recreationally harvestable shellfish resources. Information included in the current publications would be combined with the proposed map to support conservation and a sustainable resource.

ACTIONS/ACTIVITIES

1. Collate information from existing maps to produce one map showing harvestable shellfish resource locations and public access points.
2. Produce map of current harvestable locations. Office of State Planning GIS personnel will put the information on the base map. The information will become part of the statewide GIS (GRANIT) system.
3. An additional component of this project will be updating the existing shellfish location database with the acreage of the resource, an estimate of the density, and date of the most recent inventory. The database will be kept by NH OSP and updated as more beds are identified and existing beds are re-inventoried (as personnel and funds are available).
4. Distribute the completed map to resource managers, and to the public with the purchase of a shellfish license.
5. Post this information on pertinent websites, including NH Fish and Game, NHCP, NHEP, and UNH/CICEET and update when necessary.

RESPONSIBLE PARTIES

NH Fish and Game is responsible for the implementation of this action (Steps 1-5) with assistance from the UNH Jackson Estuarine Laboratory (Steps 1, 3), NH Office of State Planning (Step 2), and NHEP (Steps 3-5).

IMPLEMENTATION LOCATION

Not applicable

COSTS

The cost of producing 5,000 maps (24" x 17" folded brochure, 2-sided, 4-color) for distribution to the public will be approximately $5,000.

FUNDING

This action may be funded through US EPA NHEP implementation funds or through other appropriate federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH Fish and Game, NH DES, and NH OSP could also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

NH F&G will be able to more easily respond to public inquires for information. Shellfish harvesters will know how to find and access productive beds.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Highest Priority action will be initiated by 2004.

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PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH OUTREACH

PRIORITY

+

ACTION SHL-11

Establish Bounty of the Bay shellfishing field education program.

BACKGROUND

Current shellfisher licensing information reveals an aging constituency. Like many outdoor recreational pursuits, participation and continuing commitment usually results from an early introduction by a family member or other mentor. Increased shellfish license sales and the opening of more shellfish beds to harvest shows growing interest in shellfishing in New Hampshire in recent years, but outreach programs to families and young people would encourage more children and families to discover this traditional Seacoast activity. A *Bounty of the Bay* shellfishing course will provide opportunities for a new generation of shellfishers to enjoy the activity and learn the most current information on proper harvesting techniques, public health and water quality issues, and natural history. A more informed constituency should lead to more support for the resource and for management programs.

ACTIONS/ACTIVITIES

1. Offer the Bounty of the Bay: Shellfishing from the Flats to the Table Field Education course. This course is initially intended to promote clamming in Great Bay using the Sandy Point Discovery Center as a base of operations and source of staff and expertise. This program can be extended to oystering in Great Bay and/or clamming in Hampton-Seabrook Harbor at additional expense.
2. Coordinate with recreational users and professionals from related agencies to assist with the course.
3. Use appropriate media to advertise and register participants.
4. Establish course curriculum:
   - Who and what are involved in New Hampshire shellfish management (e.g. openings and closures, sanitary surveys, and resource assessments).
   - Welcome to Shellfishing in New Hampshire slideshow.
   - Natural history information on the ecological value of shellfish to a fully functioning estuarine system.
   - Water quality issues relating to shellfish.
   - Public health and shellfishing.
   - Equipment: To make or to buy?
   - Hands-on component: include proper harvesting techniques with an emphasis on “taking only what you need”
   - Proper care of harvest and hands-on preparation: “101 ways to cook a clam”

5 Consider charging a nominal fee for the workshop and arranging to apply workshop fee toward the purchase of a shellfish license, or obtaining money to purchase shellfish license for participants, as an incentive to participate.

RESPONSIBLE PARTIES

Great Bay National Estuarine Research Reserve will take the lead in developing this program with assistance from New Hampshire Fish and Game Department (Steps 1-5), the New Hampshire Shellfish Sanitation Program (New Hampshire Department of Environmental Services), and New Hampshire Department of Health and Human Services will be consulted.

IMPLEMENTATION LOCATION

The pilot field day will be offered at the Great Bay National Estuarine Research Reserve Sandy Point Discovery Center. Other sites may be developed where appropriate shellfish resources and land-based facilities are available.

COST

Participation by the public will require the purchase of a New Hampshire shellfish license ($21.00). Cost for the program will be borne by the New Hampshire Fish and Game Department and Great Bay National Estuarine Research Reserve (Steps 1-5). A limited amount of equipment is currently available, but availability of clam forks, etc., would enhance the program. Estimate for supplies: $250-300 (Step 1).

Costs for programs conducted at locations other than Sandy Point are estimated at $1,000 per offering including staff time, materials, and promotions (Step 1).

FUNDING

This action will be funded by the Great Bay Research Reserve. Supplies may be funded by charging a fee for the workshop or through State funds available through natural resource management agencies such as NH DES, NH F&G and NH OSP could also support this action.

EXPECTED BENEFITS

A new constituency of shellfishers will:

- Bring needed support to new shellfish management programs and efforts.
- Continue a rich New Hampshire tradition.
- Help to improve shellfish resources and water quality by building the support of a more informed public.
- The classes will provide a fun, newsworthy media event creating a spotlight on shellfish, water quality, and the host of current management activities.

MONITORING AND ENFORCEMENT

Program attendance is the best direct measure of field class success. No enforcement actions are anticipated.

TIMETABLE

This Priority action will be initiated in 2001.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION SHL-12

Develop and maintain a shellfisher license information database that includes mailing and demographic information.

PRIORITY

SHELLFISH OUTREACH

BACKGROUND

A Memorandum of Agreement (MOA) will be drafted in 2000, establishing the new, restructured state shellfish sanitation program as detailed in Action SHL-1. This MOA between the New Hampshire Fish and Game Department, New Hampshire Department of Environmental Services, and the New Hampshire Department of Health and Human Services will outline the responsibilities of the various state agencies charged with managing shellfish growing waters classification in accordance with the National Shellfish Sanitation Program. This agreement should ensure that mailing and demographic information compiled by New Hampshire Fish and Game from shellfish license applications is available to the agencies responsible for shellfish growing waters classification and shellfish resource management for the purpose of distributing educational information to license holders. The database is currently kept at New Hampshire Fish and Game Department offices in Concord.

ACTIONS/ACTIVITIES

1. Ensure a shellfisher database will be maintained, and made available to all New Hampshire agencies involved in shellfish management.
2. Limit the use of the database to the distribution of educational information, e.g., water quality and public health information, shellfish resource management, regulatory information, meeting notices, harvesting tips, maps, and other material specifically related to the New Hampshire shellfishery.

RESPONSIBLE PARTIES

New Hampshire Fish and Game is the lead on this action. NH F&G currently maintains a database of information gleaned from license applications (Step 1); New Hampshire Shellfish Sanitation program, represented by New Hampshire Department of Environmental Services, the New Hampshire Office of State Planning, NHEP, and New Hampshire Department of Health and Human Services, are potential recipients and users of the database information (Step 2).

IMPLEMENTATION LOCATION

Not applicable

COST

No additional costs anticipated

FUNDING

Costs for building and maintaining the database will be borne by NHF&G, as they already maintain the information in a database format.

EXPECTED BENEFITS

- More effectively distribute current information on shellfish resource management, water quality, and shellfish, and their roles in estuarine ecology to those stakeholders who are most affected.
- Establish direct communication with the shellfishing public to build the credibility of shellfish resource management and shellfish sanitation practices in New Hampshire.
- Enhance stewardship of shellfish resources by a more informed shellfishing public.
- The database may help in identifying key members of the shellfishing community who may be enlisted as "shellfish stewards."
- Agencies charged with all aspects of shellfish management in New Hampshire will have direct mail access to shellfishers.
- Agencies charged with all aspects of shellfish management in New Hampshire will have access to demographic and harvest pressure information from shellfishers.

REGULATORY NEEDS

Memorandum of Agreement.

TIMETABLE

This shellfisher database (Step 1) currently exists and is maintained by NH F&G. Use of the database for mailings by DES and DHHS (Step 2) will occur on a regular basis.

PRIORITY

Priority. Implementation of this action will help in the implementation of other Action Plans listed in the *NHEP Management Plan*, particularly Action EDU-5.

ACTION SHL-13

Update materials issued with shellfish licenses, improve distribution of pertinent information, and better utilize the New Hampshire Fish and Game Department's "Clam Hotline."

PRIORITY

SHELLFISH OUTREACH

BACKGROUND

Active New Hampshire shellfishers are directly affected by many aspects of estuarine management. As a group the shellfishers may have a profound positive influence on New Hampshire's estuarine resources.

New Hampshire Fish and Game provides vendors of shellfish licenses with harvesting and regulatory information to distribute with the purchase of a New Hampshire shellfishing license, but these materials may not always be given to the shellfishers. A more reliable means of distribution needs to be devised to ensure this information is received by the shellfishing public.

New Hampshire shellfishers have come to rely on NH F&G's "Clam Hotline" for the most current information on the status of the shellfish beds. The hotline can deliver brief messages directly to the shellfishing public, such as location of bed openings and closings.

ACTION/ACTIVITIES

Seasonal mailings can be used to reach active New Hampshire shellfishers directly with information on:

- proper harvesting techniques;
- the resource management program;
- updates on water quality improvements that support shellfishing;
- maps and shellfish-specific tide information;
- invitations to shellfish-related meetings, workshops, and activities.

RESPONSIBLE PARTIES

New Hampshire Fish and Game Department and New Hampshire Department of Environmental Services will take the lead in updating existing materials and identifying needs for new materials. The New Hampshire Department of Health and Human Services, the New Hampshire Coastal Program, and the New Hampshire Estuaries Project may assist where appropriate.

IMPLEMENTATION LOCATION

Not applicable.

COSTS

Postage (per year)	$2,000
Administration/publication/printing costs	$4,000
Map reproduction by NHCP - 5000 copies	$0 (in SHL-10)
Reproduction of existing materials (no color)	$500
Total	**$6,500**

FUNDING

New funding for this program should augment that currently provided by New Hampshire Fish and Game Department. The restructured New Hampshire shellfish sanitation program under New Hampshire Department of Environmental Services will contribute assistance to the efforts. Additional sources could include New Hampshire Coastal Program grants, New Hampshire Department of Environmental Services non-point source program education funds, and the New Hampshire Estuaries Project.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Provide current shellfish resource management, water quality, and public health information to those stakeholders who are most directly affected.
- Help the New Hampshire shellfish sanitation program improve its credibility with the shellfishing public.
- Increase shellfishers' sense of participation in the management of the resource.
- The shellfish resource will benefit from better-informed harvesters.
- More shellfishers may become active supporters of estuarine water quality improvements.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action will be significantly enhanced by implementation of Action SHL-11.

ACTION SHL-14

Provide for direct citizen involvement in the New Hampshire shellfish management decision- making process.

PRIORITY
+++ SHELLFISH OUTREACH

BACKGROUND

Throughout the *NHEP Management Plan* development process, both the Shellfish and Public Outreach and Education project teams have discussed the benefits of citizen participation in shellfish resource management and shellfish sanitation programs. The project teams recognized that citizen participation may increase shellfisher confidence in the state's public health, shellfish sanitation, and shellfish resource management strategies. Citizens who choose to become involved in the shellfish management decision-making process may become a core of advocates or "shellfish stewards." Active harvesters with a role in managing the resource may be effective "on-the-flats" educators, assisting the state agencies charged with administering the New Hampshire shellfish management programs.

Some avenues for citizen participation in shellfish management already exist in New Hampshire. The Advisory Committee on Shore Fisheries is a legislatively appointed committee of citizens and agency representatives charged with overseeing and developing policy for many of New Hampshire's marine and estuarine resources. New Hampshire Fish and Game Department solicits input from this committee on policy and management decisions related to many marine topics including the shellfisheries. The Advisory Committee on Shore Fisheries is an appropriate venue for citizens to voice concerns regarding shellfish management and shellfishery policies. However, public knowledge of the committee and its public participation process appears limited.

Since 1997 the New Hampshire Estuaries Project has provided for public input into the New Hampshire Department of Health and Human Services shellfish sanitation program through the NHEP Shellfish Project Team. Shellfishers participating in this working group helped shape and prioritize the sanitation and water quality monitoring program that resulted in the opening of 1,622 acres of shellfish-growing waters, including the Seabrook Middle Ground and Lower Little Bay.

The New Hampshire Department of Environmental Services has found input from this group so valuable that NH DES intends to continue to use the NHEP Shellfish Team as a public advisory committee as it takes the lead in the restructured shellfish sanitation program. If NHEP were to disband the Shellfish Team, NH DES would create a similar public advisory committee. However, shellfisher knowledge of the NHEP Shellfish Team and its opportunities for public participation also appears limited.

Concerned citizens may also participate more or less directly in New Hampshire shellfish management through citizen's groups like Great Bay Coast Watch. The water-quality monitoring and pollution-source identification work of Great Bay Coast Watch volunteers has been instrumental to the progress made in the shellfish sanitation and pollution source identification efforts of NH DHHS, NHEP, and NH DES.

ACTION/ACTIVITY

1 NH F&G will inform the shellfishing public about the Advisory Committee on Shore Fisheries, including:

- who serves on the committee and how members are appointed;
- the Committee's responsibilities, jurisdiction, and limitations;
- how public input is submitted to the committee, and how committee findings are reported to the public;
- committee meeting dates, times, and locations, available from New Hampshire Fish and Game Department at (603) 868-1095.

2 NH DES will inform the shellfishing public about the Shellfish Sanitation Advisory Committee/NHEP Shellfish Project Team, to include:

- encouragement of open public participation in committee meetings;
- definition of the Committee's responsibilities, jurisdiction, and limitations.

3 Continue support for volunteer monitoring activities that support shellfish resource management and shellfish sanitation programs (see Action EDU-5).

RESPONSIBLE PARTIES

- Activities related to the Advisory Committee on Shore Fisheries (Step 1): New Hampshire Fish and Game Department.
- Activities related to the Shellfish Sanitation Advisory Committee (Step 2): New Hampshire Department of Environmental Services should take the lead with possible assistance from NHEP and New Hampshire Department of Health and Human Services.
- Volunteer monitoring: see Action EDU-5.

COST

Advisory Committee on Shore Fisheries in Step 1	
Mailing and public notification	$2,000
Workshops and meetings	$2,000
NH DES Shellfish Sanitation Advisory Committee in Step 2	
Mailing and public notification	$2,000
Workshops and meetings	$2,000
Total	**$8,000**

FUNDING

This action, except for costs for workshops and meetings, may be funded in part through US EPA NHEP implementation funds or through other federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP will also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Provide current shellfish resource management, water quality, and public health information to those stakeholders most directly affected.
- Help build the credibility of the New Hampshire shellfish sanitation program with the shellfishing public.
- The shellfish resource will benefit from a more informed shellfishing public.
- Increase shellfishers' sense of participation in the management of the resource.
- More shellfishers may become active supporters of estuarine water quality improvements.

TIMETABLE

Step 1 currently initiated by NH F&G public comment procedures. Step 2 will be initiated in 2001. Step 3 is supported by funding for WQ-5, volunteer support for shoreline surveys, in 2000-2002.

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PRIORITY

Highest Priority. Implementation of this Action is in part related to implementation of Action EDU-5.

SHELLFISH AQUACULTURE

PRIORITY
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ACTION SHL-15

Evaluate and address perceived and real institutional barriers to aquaculture and promote environmentally sound aquaculture practices.

BACKGROUND

Commercial shellfish aquaculture can provide a variety of benefits to the Seacoast region but must be carefully examined to ensure it does not negatively affect the environment. The unintended introduction of exotic species and effluent from aquaculture areas can have negative impacts on environmental quality. Aquaculture can co-exist with recreational shellfishing and be consistent with environmental stewardship. The application of aquaculture technologies to public resource management can also benefit both recreational harvesting and resource restoration for habitat and ecological health.

A commercial shellfish aquaculture industry in New Hampshire would be small compared to neighboring states due to geographic limitations, but excellent opportunity exists to develop a viable industry. For example, if 50 acres of the tidal waters in the Great Bay Estuary were effectively cultivating oysters and disease problems could be overcome, farmers could potentially produce 25,000 bushels of oysters and gross revenues of $1.5 million annually.

Considering the current crisis and uncertain future of the capture fisheries, the commercial fishing community and the Seacoast economy could benefit from identifying and realizing aquaculture opportunities. Recent scientific evidence of water quality and ecosystem benefits from increased filtration by bivalves indicates that expanding shellfish culture could also improve water quality. Environmentally sound aquaculture practices that do not impact existing benthic (bottom-dwelling) or pelagic (open ocean) resources can increase filtration capacity by adding large numbers of bivalves to the system.

Obstacles to development of the industry include negative attitudes toward aquaculture held by some recreational harvesters and riparian landowners; philosophical disagreements over granting exclusive rights to a cultivated resource in public waters; concerns about the lack of federal shellfish sanitation certification (NSSP) in New Hampshire; leasing and permitting processes and costs; and product security issues. Education, planning and technology transfer activities are needed to stimulate industry development.

ACTIONS/ACTIVITIES

1 UNH Sea Grant has funded an ongoing effort to evaluate perceptions and attitudes toward aquaculture including commercial fishermen, tourists, policy makers, and coastal communities.

In addition, plan and hold a series of informational and discussion sessions on aquaculture. Identify and invite stakeholders including all those mentioned above, plus recreational fishermen and riparian landowners. Areas of disagreement or conflict should be identified and resolutions sought. Desired outcomes include a public better educated about aquaculture of shellfish, finfish, seaweed, etc.; identification of methods and

locations where conflict is minimal; and an estimate of the capacity for industry development. Hold meetings in Durham, Portsmouth, Stratham, Rye, and Seabrook.

2 **Permitting**. Streamline the permitting process so applicants will know how to submit one permit that is reviewed by all appropriate agencies in a timely manner. Review licensing and other fees for aquacultural operations and revise as necessary. All regulatory agencies requiring or involved in permit applications should meet and develop a plan to adequately address coordination, communication, and other issues. Specific changes need discussion, such as developing administrative rules requiring a written application to the state agency which certifies sanitation for aquaculture ventures in a shellfish-growing area.

3 **State compliance with NSSP**. Agencies need to identify and correct deficiencies in the program, as authorized by state law (RSA 143) and outlined in Action SHL-1.

4 **Technology transfer.** Offer training programs for prospective aquaculturists including methods to reduce environmental impacts. Successful examples are Harbor Branch in Florida and Pemaquid Oyster in Maine. UNH laboratories are ideal locations for training sessions.

5 **Ongoing review of scientific knowledge.** Regularly review and disseminate current knowledge of aquaculture-related issues – environmental impact reduction and control, disease control, improvements in aquaculture methods, etc. – to assist the aquaculture industry, regulatory community, and other interested parties.

RESPONSIBLE PARTIES

Evaluation of perceptions and attitudes toward aquaculture (Step 1)

UNH Sea Grant has funded a series of surveys on this topic with cooperation from NH Fish and Game, the scientific community, aquaculture professionals, the commercial fishermen's association, non-governmental environmental groups, and outreach and education professionals from organizations such as UNH Sea Grant, NHEP, NH Coastal Program, and the Seacoast Science Center.

Permitting (Step 2)

NH Fish and Game, Army Corps, NH DES, National Marine Fisheries Service, US Fish and Wildlife Service, NH Coastal Program

State Compliance with NSSP (Step 3)

NH DES (lead agency), with assistance from NH DHHS, NH Coastal Program, and NH Fish and Game

Technology Transfer (Step 4)

Scientific community, aquaculture and fishing industry, UNH Sea Grant, NHEP, NH Coastal Program, NH Fish and Game

Ongoing Review of Scientific Knowledge (Step 5)

Scientific community, aquaculture and fishing industry, UNH Sea Grant,

NHEP, NH Coastal Program, NH Fish and Game

IMPLEMENTATION LOCATION

Opportunities for marine aquaculture development in New Hampshire are very site specific, and will be considered or addressed in detail in the public perceptions, state permitting and NNSP compliance activities of this Action Plan.

COSTS

Evaluation of aquaculture perceptions and attitudes (Step1)

Grant to cover cost of workshops/meetings
from UNH Sea Grant: $3,000-$5,000

Permitting (Step 2)

NH Fish and Game, Army Corps, NH DES Wetlands Bureau,
NH Coastal Program (staff time only). No cost beyond staff time.

State compliance with NSSP (Step 3)

Accomplished by, and costs accounted for, Action SHL-1

Technology transfer (Step 4)

UNH Sea Grant, NHEP,
NH Coastal Program, NH F&G: $10,000-$20,000/year

Ongoing review of scientific knowledge (Step 5)

UNH Sea Grant, NHEP, NHCP, NHF&G: $5,000-$10,000/year

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES, NH F&G and NH OSP could also support this action. Scientific research may be funded through other academic research awards.

REGULATORY NEEDS

Changing permitting procedures and gaining FDA certification of the state shellfish program may require some changes to state laws and/or administrative rules.

EXPECTED BENEFITS

A viable aquaculture industry can provide:

- economic benefits to commercial fishermen and the Seacoast region;
- environmental benefits through increased water filtration capacity of the estuarine ecosystem;
- the development of technologies that can be used to enhance or restore shellfish resources for recreational harvest.

MONITORING AND ENFORCEMENT

Evaluation of aquaculture perception/attitudes

NH F&G, NH Coastal Program, NHEP

Permitting

NH F&G, Army Corps of Engineers, NH DES, NH Coastal Program.

State compliance with NSSP

NH DES (lead agency), with assistance from NH DHHS, NH Coastal Program, NH Estuaries Project, and NH Fish and Game.

Technology transfer

No requirements identified.

Ongoing review of scientific state of knowledge

No requirements identified

TIMETABLE

Step 1 has been studied through a series of surveys between 1997-2000. Steps 2-5 will be initiated by 2004.

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PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions in the *NHEP Management Plan*, although Action SHL-15 is related to Action SHL-1.